

## PLATE XLI.

Fig.

1. *Glyphodes xanthostola*. ♂.
2. *Polythlipta camptozona*. ♀.
3. *Lepyrodies argyrosticta*. ♂.
4. *Crocidophora flaviciliata*. ♂.
5. " *cafferalis*. ♂.
6. *Phlyctenodes argyrostacta*. ♂.
7. " *fluvini-gratis*. ♂.
8. *Noorda rubricostalis*. ♂.
9. *Macna hamptoni*. ♀.
10. *Ichneumenoptera cyanescens*. ♂.
11. *Lepidopoda fulvipes*. ♀.
12. *Melittia aurip Plumia*. ♀.
13. *Dalaca stictigrapha*. ♂.
14. *Polyptychus baxteri*. ♀.
15. *Philotherma fuscescens*. ♂.

Fig.

16. *Gonometa drucei*. ♀.
17. *Lepidopoda flavipalpis*. ♂.
18. " *obliquizonia*. ♂.
19. *Melittia ignidiscata*. ♂.
20. *Dalaca holophaea*. ♂.
21. *Macalla melanobasis*. ♂.
22. *Glyphodes mayottalis*. ♂.
23. *Pyrausta rufilinearis*. ♀.
24. *Criophthona sabulosalis*. ♂.
25. *Rhodoneura discata*. ♂.
26. *Sylepta megastigmatis*. ♂.
27. *Constantia aglossalis*. ♀.
28. *Bostra tenebralis*. ♂.
29. *Altha tegula*. ♂.

2. The Urogenital Organs of *Chimæra monstrosa*. By T. H. BURLEND, M.A. (Camb.), B.Sc. (Lond.), late Scholar of Christ's College, Cambridge; Assistant Lecturer and Demonstrator in Zoology, University College, Cardiff.\*

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(Text-figures 40-53.)

*Introduction.*

The study of the structure of the Chimæroids is full of interest on account of the diversity of opinion which exists with regard to the relationship of the Holocephali to the Elasmobranchii. Although retaining many primitive characters in the skeleton, brain, sense-organs, and viscera, the Holocephali have nevertheless acquired very specialised structures presumably associated with their occurrence and mode of life. Referring more particularly to the urogenital organs and their accessory parts, the Chimæroid is unique among Fishes in the possession in the male of a pair of "middle claspers,"—regarded by T. J. Parker (1886) as a rudimentary third pair of limbs,—and in the female of a so-called "receptaculum seminis," mentioned by Leydig (1851) and by subsequent writers.

Notwithstanding the excellent contributions of Leydig and Hyrtl over fifty years ago, and the more recent work of Mazza and Redeke, it was felt that a more detailed account, with figures, of the urogenital organs of *Chimæra* is not readily accessible to English readers, and it was to supply this want that the work was primarily undertaken. Further investigation showed that the published accounts were at variance on points of the first importance, and this fact can now be attributed to: (1) the use of imperfectly preserved material, and (2) the structural differences existing between animals which are immature and those

\* Communicated by Professor W. N. PARKER, Ph.D., F.Z.S.

which have attained sexual maturity. With the material at my disposal I have been able to make additions to the above accounts and also to verify much of the early work which some later writers have in part disputed.

My best thanks are due to Professor W. N. Parker of this College, who suggested the work and rendered me much assistance by his friendly criticism and advice in the course of these investigations. A preliminary account of the relations of the vasa efferentia has already appeared under our joint names (15).

### *Historical.*

Leydig (1851) described the urogenital system of *Chimæra monstrosa*, both male and female. He observed the network of small ducts on the ventral surface of the testis and the manner in which these minute ducts unite to form the larger ducts—vasa efferentia—which are directed towards the “Nebenhoden” or coiled anterior portion of the sperm-duct. The different regions of the sperm-duct are described, though not by the aid of transverse sections, but by dissection only. Moreover, Leydig’s work is very important in that he differentiates in the male the posterior brown kidney from the anterior white structure called by Hyrtl the “Leydig’s gland,” and he examined the secretion from this latter. The author concluded that it must be regarded as an accessory genital gland. In his account of the female organs Leydig made special reference to the “shell gland” and “uterus” of the oviduct, and looked upon the “digitiform gland”—the “receptaculum seminis” of later writers—as most probably an accessory female genital gland.

Hyrtl (1853) continued Leydig’s work on *Chimæra*, although he was not so fortunate in obtaining fresh material. He could not decide whether the cavity dorsal to the peritoneum between testis and “Nebenhoden” was a lymph sinus, or whether it was in connection with the anterior coiled end of the sperm-duct and consequently a cœlomic intermediary between the testis and its duct. Both Leydig and Hyrtl believed that vasa efferentia must be present, but could not locate them with accuracy, nor determine their relation with the sperm-duct. Hyrtl regarded the most anterior duct from the Leydig’s gland as the real beginning of the sperm-duct: the “digitiform gland” was held to be a reservoir for the reception of the sperms of the male.

Mazza (1894) believes that the testis is not connected with its “Nebenhoden,” the spermatozoa from the former reaching it by first passing into a portion of the body cavity and thence getting into the coiled anterior end of the sperm-duct by means of canals (≠ mesonephric tubules).

Redeke (1898) does not throw any light on this point. He divides the kidney into cranial, median, and caudal zones; but this distinction is untenable, since the cranial zone as indicated in his figures is in reality the anterior coiled end of the sperm-duct,

the median zone is Leydig's gland, and the caudal zone alone is excretory in the adult male. The author emphasizes the primitive nature of the kidney on account of its marked metamerism, and apparently believes that the sexual portion of the Selachian kidney is absent.

Bashford Dean (1906) does not recognise any "Geschlechtsniere."

W. N. Parker and T. H. Burlend (1909) show the relation between vasa efferentia and sperm-duct, the former uniting to give a longitudinal duct which is directly continuous with the coiled sperm-duct, so that the sexual part of the kidney or "Geschlechtsniere" is represented in the adult male by the "rete testis." Attention is also directed to the unsatisfactory use of the term "epididymis."

#### *Material and Observations.*

I am indebted to Mr. J. J. Neale of Cardiff for much valuable material. The Chimæras, both young and adult, male and female, had been carefully packed in ice and arrived at the laboratory in excellent condition. The alimentary canal having been removed, the whole urogenital region was fixed in corrosive sublimate, 90 per cent. alcohol or 5 per cent. formalin; but the first of these reagents proved the most satisfactory for histological work, the formalin-preserved specimens being most suitable for dissection. Many of the regions were sectioned, and this was especially difficult in the coiled sperm-duct region owing to the slow rate of penetration by the successive reagents. Weigert's Hæmatoxylin was used for staining in bulk, and Delafield's or Ehrlich's acid Hæmatoxylin for staining on the slide; the Cambridge rocking microtome was used in sectioning.

#### ADULT MALE *CHIMÆRA MONSTROSA.*

##### *Genital organs.*

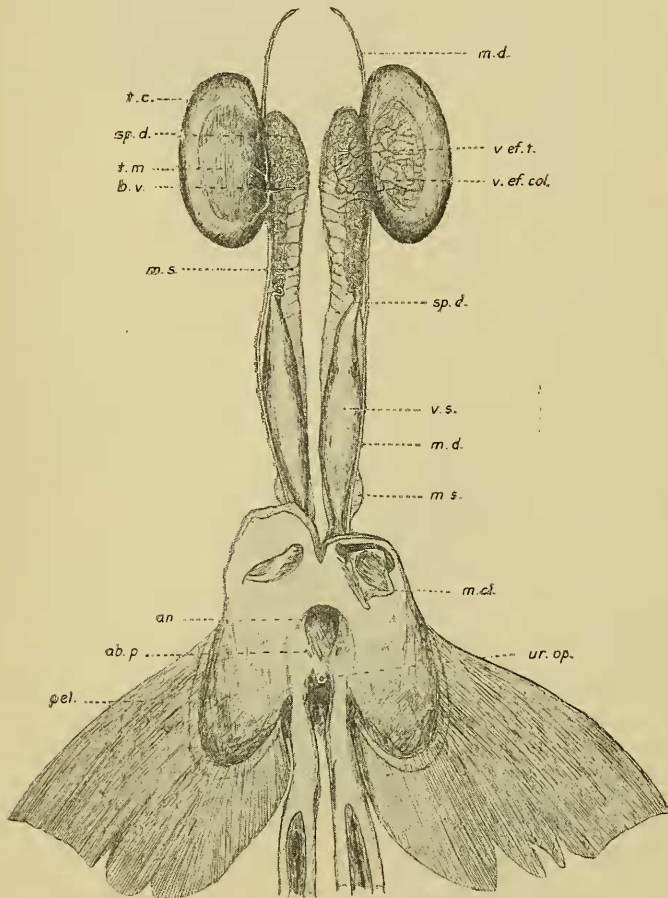
(a) *Claspers.*—The anterior clasper, three-quarters of an inch in length, is situated on the head in the dorsal middle line a short distance behind the snout. It is a spherical knob-like organ bearing recurved spines ventrally, borne on a short thick stalk directed forwards; the whole organ is capable of being depressed into a shallow pit immediately in front of it and so of becoming less conspicuous.

The middle claspers are wing-like structures practically hidden away in pouches situated at the anterior limit of the pelvic-fin skeleton. In the extended condition they are seen to have cartilaginous supports bearing a row of from 5-7 forwardly projecting spines on the edge nearest the ventral middle line. In text-fig. 40 the left middle clasper is shown everted, *m.cl.*, the clasper on the right side being indicated in the normal position.

The posterior paired claspers, situated behind the anus and on each side of the urogenital aperture, are stout rod-like structures,

each divided distally into two main portions with corresponding cartilaginous supports; the parts covered with skin are provided with numerous small forwardly projecting spines, and each clasper is about four inches in length; at the proximal end of

Text-fig. 40.



Urogenital organs of adult male *Chimæra monstrosa* ( $\times \frac{1}{2}$ ),  
with pelvic fins and claspers (ventral view).

*ab.p.*, abdominal pore on right side; *an.*, anus; *b.v.*, blood-vessel (removed on right side); *m.cl.*, left middle clasper extended; *m.d.*, Müllerian duct; *m.s.*, Leydig's gland; *pel.*, pelvic fin; *sp.d.*, sperm-duct or Leydig's gland; *t.c.*, white cortical region of testis; *t.m.*, green medullary region of testis; *ur.op.*, urogenital opening; *v.ef.col.*, longitudinal collector of efferent ducts; *v.ef.t.*, network of efferent ducts on testis; *v.s.*, seminal vesicle.

each is a swollen glandular structure which secretes a tallowy fluid of uncertain function.

(b) *Testes, vasa efferentia, sperm-ducts, and glands of Leydig.*—The bean-shaped testes attain a length of from  $1\frac{1}{2}$  to 2 inches in the well-developed male adult, and are suspended from the dorsal body-wall by peritoneum in the anterior region of the abdominal cavity. The peritoneum also covers the ventral surface of the corresponding Leydig's gland and sperm-duct, but not their dorsal surfaces, whereas it closely invests each testis and then passes over the neighbouring body-wall. In the centre of the dorsal surface of the testis there is a crescent-shaped flap of lymphoid tissue, between which and the inner border of the testis the peritoneum is not contiguous, and so a space is left between the latter and the testis (text-fig. 41, *t.f.*).

The ventral surface of the gonad in the fresh condition presents a white cortical and a greenish medullary area; beneath the peritoneum of the latter a network of minute vessels may be detected by the aid of a lens (text-fig. 40, *v.ef.t.*). These are continuous with the testis crypts and are filled with spermatozoa. They unite to form larger vessels, the whole network—rete testis—ultimately giving rise to six vasa efferentia, which are directed towards the anteriorly coiled sperm-duct on the inner side of the testis. After traversing, on the dorsal side of the peritoneum, the space between the gonad and its duct, they pass into a longitudinal collecting duct, the most posterior of the vasa efferentia, however, being an exception, since it never reaches the above-mentioned duct but ends blindly in the peritoneum.

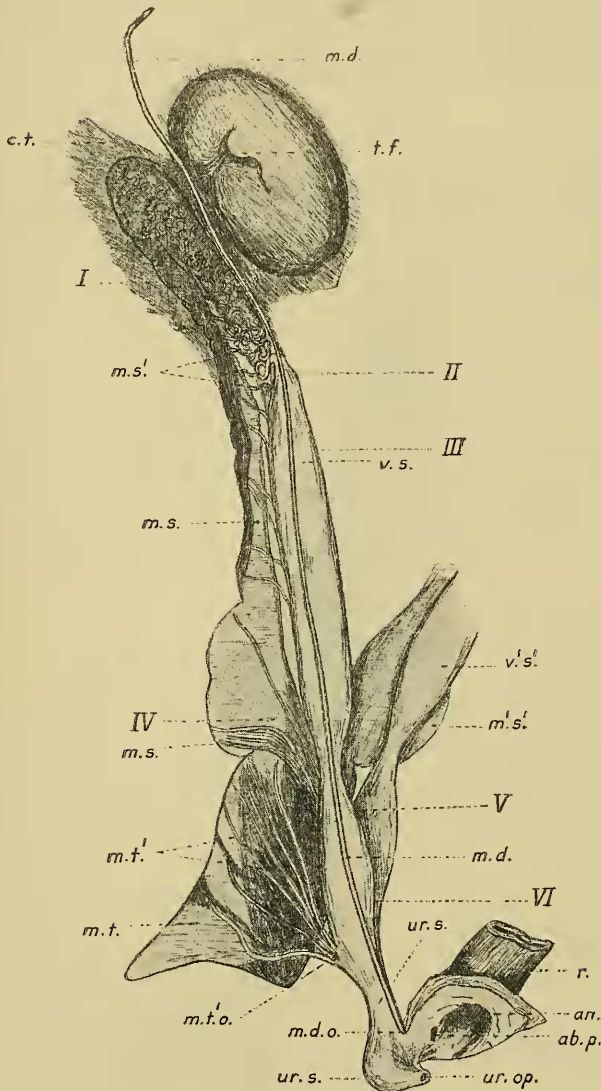
The collector passes forwards and gradually sinks in between the numerous coils of the sperm-duct of this region, but then bifurcates, and the two ducts formed proceed some short distance before finally fusing to establish the Leydig's duct or sperm-duct by an increase in diameter, but in the nature of the lining epithelium and contents identical with the collecting duct.

The sperm-duct does not pass directly backwards but forms a conspicuous much coiled structure which more posteriorly becomes less intricate, so that its winding course may be followed. After this, the diameter of the duct greatly increases and gives rise to a long straight sperm-vesicle, which becomes constricted about one-third of the distance from its posterior end, but enlarges again and ultimately opens near the opening of its fellow on the other side into a much narrower median urogenital sinus (text-fig. 41, *ur.s.*).

Running along the inner border of each sperm-duct, and later becoming dorsal to the sperm-vesicles, are two white glands showing distinct traces of metamerism, complete anteriorly but not so marked at their posterior ends: these are the glands of Leydig, almost ribbon-like in front, but less flattened dorso-ventrally, and much wider behind. They extend from the level of the middle of the testes to the constricted regions of the sperm-vesicles.

From each segment of Leydig's gland in front, there passes off

Text-fig. 41.



Urogenital organs of adult male *Chimæra monstrosa*.  
Dissection from right side.

I-VI Regions in which sections shown in text-figs. 43-48 are taken respectively.

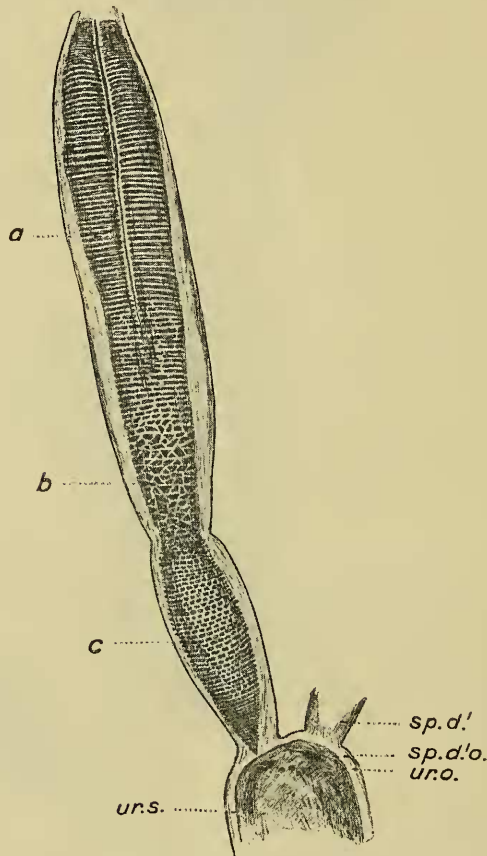
*ab.p.*, right abdominal pore; *an.*, anus; *c.t.*, peritoneum; *m.d.*, Müllerian duct; *m.d.o.*, blind ending of *m.d.*; *m.s.*, Leydig's gland, right side; *m.s.'*, collecting ducts of Leydig's gland opening into Leydig's duct; *m.s.'*, Leydig's gland on left side; *m.t.*, kidney; *m.t.'*, ureters; *m.t.o.*, their opening into urogenital sinus; *t.f.*, flap of lymphoid tissue in centre of dorsal surface of testis; *ur.op.*, urogenital aperture; *ur.s.*, urogenital sinus; *r.*, rectum; *v.s.*, right seminal vesicle; *v.s.'*, left seminal vesicle.

a duct which opens into the sperm-duct or sperm-vesicle, seven into the former and fifteen into the latter, the posterior ducts delaying their entrance into the sperm-vesicle and so having an oblique course between it and Leydig's gland.

*Structure of Sperm-Vesicles.*

These organs are white and thin-walled in fresh specimens, but the region for about an inch anterior to the constriction is pale

Text-fig. 42.



Right vesicula seminalis of adult male *Chimæra* opened from the ventral side.

- a. White thin-walled region with horizontal partitions.
- b. Pale green region traversed by a honeycomb network of partitions.
- c. Posterior white thick-walled region.

*sp.d.*, lower end of left vesicula seminalis; *sp.d'.o.*, opening of *sp.d.'* into *ur.s.*; *ur.o.*, opening into *ur.s.* of the ureters from the left side; *ur.s.*, urogenital sinus cut open.

greenish, due to its structure and contents. On dissection, the cavity is seen to be partly divided up along the whole length of the vesicula seminalis by thin connective tissue partitions, which are regularly arranged and resemble the septa of an Earthworm, in the anterior region. In the dorsal middle line, however, there is a channel along which the products of the sperm-duct may pass (text-fig. 42, *a*).

In the green region the partitions gradually lose their orderly arrangement; they appear further apart and then present a regular honeycomb on the inner face of the wall of the sperm-vesicle. Whereas, too, the contents of the anterior white region consist of closely packed spermatozoa along with some secretion from Leydig's gland, the contents in the green region consist to a large extent of the above secretion with spermatozoa scattered in it (text-fig. 42, *b*).

The posterior one-third of the seminal vesicle, beyond the constriction, is thick-walled, and the partitions become again repeated regularly, with a series of new partitions running at right angles and in the direction of the length—the contents of the compartments thus formed comprising free spermatozoa mixed with the secretion of Leydig's gland. The sperm-duct, not noticeable in the green region, now appears as a number of fine inter-communicating ducts, into which the last six ducts from the gland of Leydig empty (text-fig. 42, *c*).

#### *Histology of Sperm-Ducts and Glands of Leydig.*

Sections through the above glands show them to be of uniform structure throughout, viz., long coiled tubules of greater diameter than the urinary tubules, the lining epithelium being columnar and non-urinary, with much secretion containing nucleated material in the lumen. These tubules are continuous with the wider collecting tubes which pass across from the gland to the sperm-duct or seminal vesicle, and which also contain the same secretion as the tubules of Leydig's gland.

No glomeruli are found in the gland. This fact I was able to confirm by mounting thin pieces of the gland stained with hæmatoxylin and cleared in oil of cloves. This, no doubt, partly accounts for the white appearance of the glands of Leydig as compared with the brown kidney behind.

The nature of the contents of the sperm-ducts and sperm-vesicles was ascertained by transverse sections taken through these structures in the regions marked I–VI in text-fig. 41, and illustrated by text-figs. 43–48.

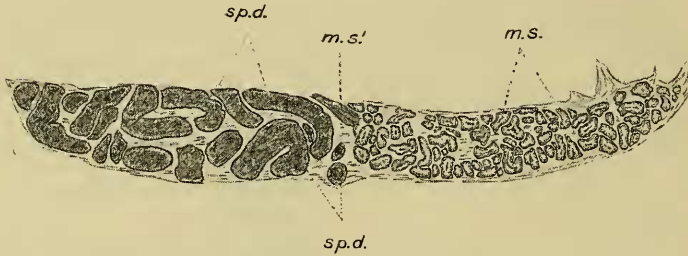
Text-fig. 43 is a somewhat diagrammatic representation of a section through region I of text-fig. 41. The sperm-duct is much coiled and its cavity is filled with spermatozoa, mostly free, although there is a tendency towards aggregation in some of the coils.

In region II Leydig's gland is larger and the sperm-duct no



longer coiled. The latter contains free spermatozoa which fill the entire lumen and yet are not massed together into bundles (spermatophores) (text-fig. 44).

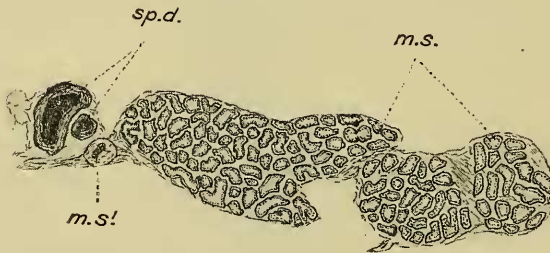
Text-fig. 43.



Transverse section of Leydig's gland and duct in region I of text-fig. 41.

*m.s.*, coils of Leydig's gland cut across; *m.s.*', duct connecting Leydig's gland with sperm-duct; *sp.d.*, coils of sperm-duct, filled with spermatozoa, cut across.

Text-fig. 44.



Transverse section of Leydig's gland and duct in region II of text-fig. 41.

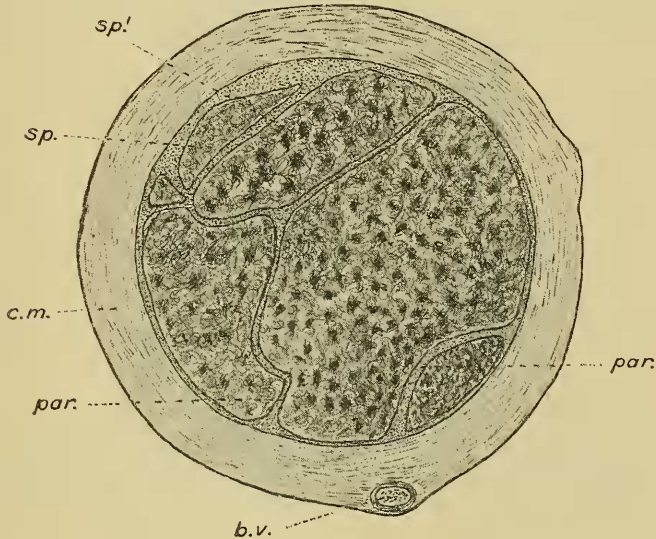
(Lettering as in text-fig. 43.)

In region III of text-fig. 41 or region *a* of text-fig. 42 the horizontal partitions (*par.* in text-fig. 45) are cut rather obliquely, and the spaces between are occupied by spermatozoa aggregated apparently into spermatophores, with a sparse admixture of the secretion from Leydig's gland. In the passage (*sp.*) along the dorsal middle line of the cavity, the spermatozoa are free and in the condition found in the sperm-duct.

A section across the sperm-vesicle in region IV of text-fig. 41 or region *b* of text-fig. 42 presents the structure indicated in text-fig. 46 (p. 520). The spaces in the honeycomb of partitions contain widely separated spermatozoa floating freely in a fluid which is derived from Leydig's gland, and is pale green in fresh specimens. In the dorsal region is the structure *ax.*—a continuation of the passage *sp.* above—containing small channels with one or other

of which the cavities marked *lu.* in text-fig. 46 are connected. On the right side of the figure the last five ducts from the gland of Leydig are cut across (*m.s.*').

Text fig. 45.

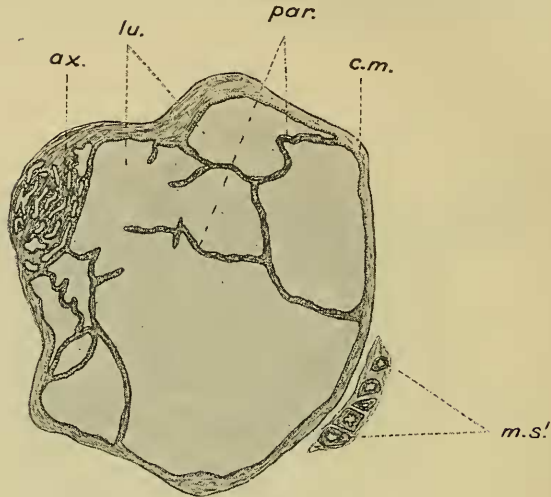


Transverse section of sperm-vesicle in region III of text-fig. 41.

*b.v.*, blood-vessel; *c.m.*, circular layer of muscle fibres; *par.*, partitions projecting from sperm-vesicle wall; *sp.*, region where spermatozoa are free; *sp.*' , region where spermatozoa are collected into bundles.

In the next figure (text-fig. 47) a section in region V of text-fig. 41 or *c* of text-fig. 42 is shown with the structure *av.* again present, with the wall of the vesicle much increased in thickness due to the presence of unstriped muscle-fibres and connective tissue, and with the collecting ducts *m.s.*' from Leydig's gland seen approximating to the structure *av.* into which they ultimately open. In the vesicle wall now appear numerous diverticula *sp.*" containing loose free spermatozoa and nucleated material secreted by the gland of Leydig. Lastly, in the posterior region of the sperm-vesicle (marked VI in text-fig. 41) the structure *av.* is absent, due to the dilatation of its channels, their fusion with one another, and the formation of a cavity into which the diverticula of the sperm-vesicle wall open (text-fig. 48). The diverticula contain peripherally (between the thick partitions) spermatozoa mixed with nucleated matter, whereas the central cavity contains free and widely separated spermatozoa floating in albuminous material in great abundance.

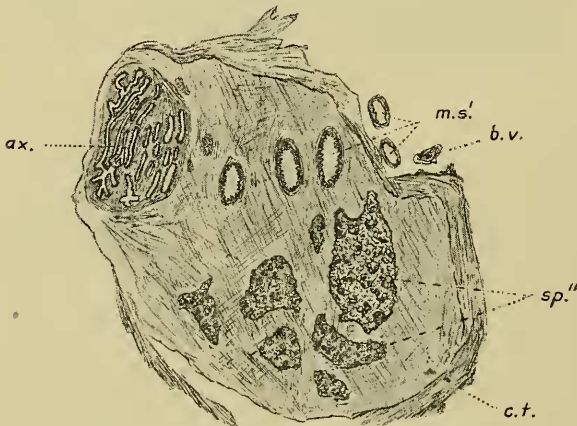
Text-fig. 46.



Transverse section of sperm-vesicle in region IV of text-fig. 41.

*ax.*, main channel of the sperm-duct much divided up; *c.m.*, circular layer of muscle-fibres; *lu.*, cavities between the partitions, containing widely separated spermatozoa in a pale green fluid; *m.s.'*, the last five ducts passing from Leydig's gland to sperm-vesicle; *par.*, partitions projecting from the vesicle-wall in this region.

Text-fig. 47.

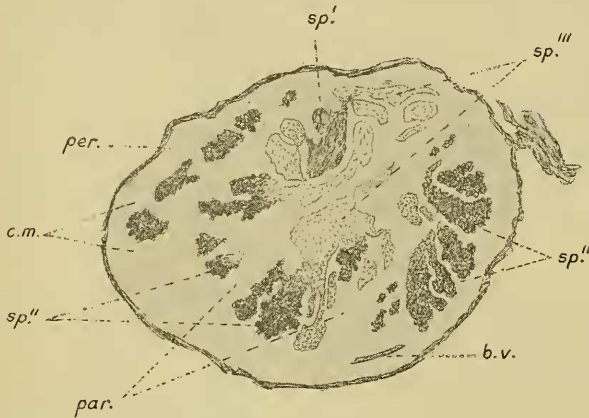


Transverse section of sperm-vesicle in region V of text-fig. 41.

*ax.*, main channel of the sperm-duct much divided up; *b.v.*, blood-vessel; *c.t.*, connective tissue; *m.s.'*, ducts passing from Leydig's gland to sperm-vesicle; *sp.''*, diverticula filled with free spermatozoa mixed with a large amount of the secretion from Leydig's gland.

Briefly, then, it may be stated that the function of the anterior part of the sperm-vesicle is that of storing up the vast number of spermatozoa produced in the testis, and it is in this region that there are temporarily spermatophores. In the middle region (pale green), the spermatozoa are thoroughly mixed with the secretion of Leydig's gland, while the posterior part of the vesicle serves as a receptacle where the free spermatozoa are collected, and most probably also nourished, by the above secretion.

Text-fig. 48.



Transverse section of sperm-vesicle in region VI of text-fig. 41.

*b.v.*, blood-vessel; *c.m.*, circular layer of muscle-fibres and connective tissue; *par.*, partitions giving rise to diverticula in the vesicle-wall; *per.*, peritoneum; *sp. I*, region containing numerous free spermatozoa, *sp. II*, diverticula where spermatozoa are found mixed with a large amount of secretion from Leydig's gland; *sp. III*, region where the spermatozoa are very widely separated and mixed with albuminous material.

*Sperm-sacs*.—No trace of these structures is found, and this is to be expected if the sperm-sacs are formed from the lower ends of the Müllerian ducts (see Borcea, 13), for the Müllerian ducts of the male *Chimera* persist, although in an undeveloped condition (see below).

#### Urinary Organs.

The glands of Leydig pass posteriorly into the true kidney, which consists of right and left halves, partly separated by connective tissue in front, but completely fused behind into a median brownish-red structure situated dorsal to the ends of the seminal vesicles. The kidney ends posteriorly in a conical portion, which extends beyond the caudal limit of the abdominal cavity. It is drained by six pairs of ureters which open together into the uro-

genital sinus by two apertures situated behind those of the sperm-ducts (text fig. 42, *ur.o.*).

*Histology.*—In section the kidney presents typical excretory tubules (not so large as the tubules in Leydig's gland), with numerous well-developed glomeruli in the dorsal region. Moreover, the ureters do not contain nucleated material such as is found in the ducts draining Leydig's gland.

#### *Urogenital Sinus.*

The median rather narrow urogenital sinus receives the sperm-duct and urinary openings at its front end, and passes dorsal to the rectum to end in a flask-shaped, somewhat laterally compressed structure, into the ventral wall of which the ends of the Müllerian ducts pass close together. The sinus opens on the apex of a median papilla behind the anus, and between the bases of the posterior claspers. Hence the cloaca, usually found in male Elasmobranchs, is absent in *Chimæra*.

Two abdominal pores situated on the latero-posterior margins of the anus put the abdominal cavity in connection with the exterior.

#### *Müllerian Ducts.*

Mere traces of the Müllerian ducts are to be found persisting in most adult male Elasmobranchs, but the male *Chimæra* possesses them in the most perfect condition.

They appear as narrow tubes running between testis and coiled sperm-duct of each side, and further back, on the outer border of the sperm-vesicle; they end blindly behind in the wall of the urogenital sinus, but open into the cœlom anteriorly by slit-like openings, quite an inch apart, situated on the posterior surface of the wall dividing the pericardial cavity from the general body-cavity. No evidence was given by either young or old male specimens of a swelling on the Müllerian duct (figured by Redeke), in the region of the shell-gland of the female.

#### YOUNG MALE *CHIMÆRA MONSTROSA*.

The urogenital organs described below belonged to an animal measuring:—

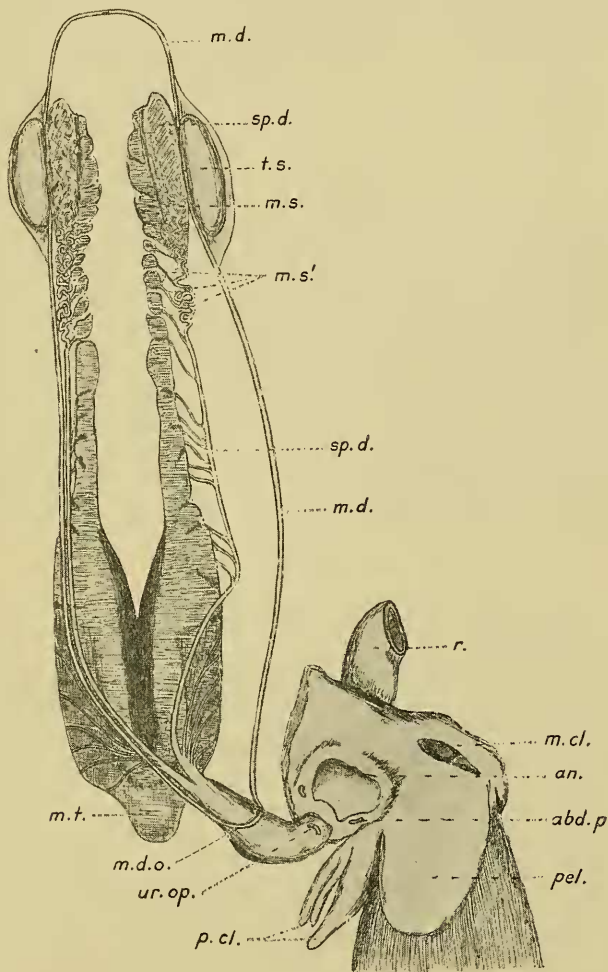
From snout to end of whip-like tail.....	30 inches.
From snout to anal opening.....	8 „

#### *Genital Organs.*

The frontal clasper is indicated, but not yet free, on the head, and no spikes are yet in evidence. The middle claspers, in pouches in front of the pelvic fins, are supported by cartilage, but are without visible spikes, and only partially developed. The posterior claspers are already well-marked, and subdivided into two main portions, but the surface is still smooth.

The biconvex oval testes are closely similar in position and appearance to the gonads of the young female, but possess a

Text-fig. 49.



Dissection of the urogenital organs of a young male *Chimera*, ventral view (nat. size).

*abd.p.*, left abdominal pore; *an.*, anus; *m.cl.*, left middle clasper; *m.d.*, Müllerian duct; *m.d.o.*, region where *m.d.* passes into wall of urogenital sinus; *m.s.*, paired portion of kidney; *m.s.'*, collecting ducts from *m.s.*, opening into Leydig's duct; *m.t.*, fused unpaired portion of kidney; *p.cl.*, left posterior clasper; *pel.*, left pelvic fin; *r.*, rectum; *sp.d.*, Leydig's duct; *t.s.*, left testis; *ur.op.*, urogenital opening.

smooth surface. They are invested with peritoneum, which also forms a ventral covering for the corresponding Müllerian duct, sperm-duct and kidney lying adjacent. In transverse sections it is possible to make out a number of efferent ducts passing into a collecting duct, which gradually passes into the coiled sperm-duct, and so the vasa efferentia and sperm-duct have the same relation as in the adult. No kidney tubules intervene, and the lining of the former (efferent ducts) imperceptibly passes into the lining found in the latter.

The anterior coiled end of each sperm-duct is, even at this period, much coiled and of greater size than the testes; at a level a little behind the latter it is but little coiled and rather wider, and then passes practically straight back along the outer border of the kidney until this joins its fellow of the other side, at which level it passes ventral to the now wide and deep kidney to fuse with the other sperm-duct in the middle line. It should be noticed that in its posterior region the sperm-duct is still of uniform diameter, the later changes to produce the seminal vesicle being not yet apparent; further, ducts pass off to the sperm-duct at intervals along the whole length of the paired portion of the kidney, with the possible exception of the first one or two segments. Behind, the unpaired kidney is drained by six ureters arising from either side, and opening separately, though very close together, into the respective sperm-ducts just before the latter fuse and open into the urogenital sinus.

#### *Urinary Organs.*

These consist of a posterior brownish unpaired portion representing the adult kidney, and two ribbon-like paired brownish bands, extending forwards to a level immediately in front of the testes, with regular segmentation, and short ducts passing into the sperm-ducts as described above. With the exception of the first one or two segments—which appear degenerate—the kidney possesses numerous glomeruli, as may be ascertained by staining and clearing in oil of cloves. Each segment of the kidney—and the segmentation, especially anteriorly, is very noticeable—apparently consists of much coiled tubules with two or three or even more glomeruli in the dorsal region. From the position and relations of the paired portions of the kidney, it is evident that later they lose their glomeruli and give rise to the glands of Leydig of the mature male adult.

#### *Urogenital Sinus.*

There is no trace of sperm-sacs, but the chamber formed by the fusion of the two sperm-ducts widens, and receives the two Müllerian ducts, which apparently pass in close together in the ventral middle line about half-way along its length. The Müllerian ducts are not in open connection, however, with the sinus, nor do they ever become so.

*Müllerian Ducts.*

At this stage the ducts of Müller surpass in diameter the sperm-ducts, and appear as tubes running in the peritoneum along the outer border of each half of the kidney, then between the testes and coiled sperm-ducts to meet anteriorly in the middle line, and open by a common aperture into the cœlom. Their lining is thrown into folds in some regions.

*Abdominal pores*, situated at the posterior margin of the anus, are both present and open.

ADULT FEMALE *CHIMÆRA MONSTROSA*.

In the adult condition the female *Chimæra* is somewhat larger than the male in size and general proportions. In all external characters (except in the absence of claspers) the female resembles the male, but differs from it in the possession of a longitudinal shallow groove in the ventral middle line of the body, a little distance behind the urogenital openings. This fleshy groove is bordered by skin white in appearance; it is lined with elongated glandular cells, extends for a distance of from  $2\frac{1}{2}$  to  $3\frac{1}{2}$  inches, and is nearly  $\frac{1}{8}$  inch deep. The urogenital organs—just as in the male—extend the whole length of the abdominal cavity and consist of two ovaries, two oviducts with shell-glands, kidney (paired and unpaired regions) with ureters and urinary bladder, and lastly, a median so-called “receptaculum seminis.”

*Genital Organs.*

The two ovaries are situated one on each side of the dorsal middle line of the abdominal cavity, suspended by the mesovarium, and situated anterior to the front end of the kidney. Irregular in outline and easily ruptured, they present a lobulated appearance due to the Graafian follicles, some of which are very large (text-fig. 50).

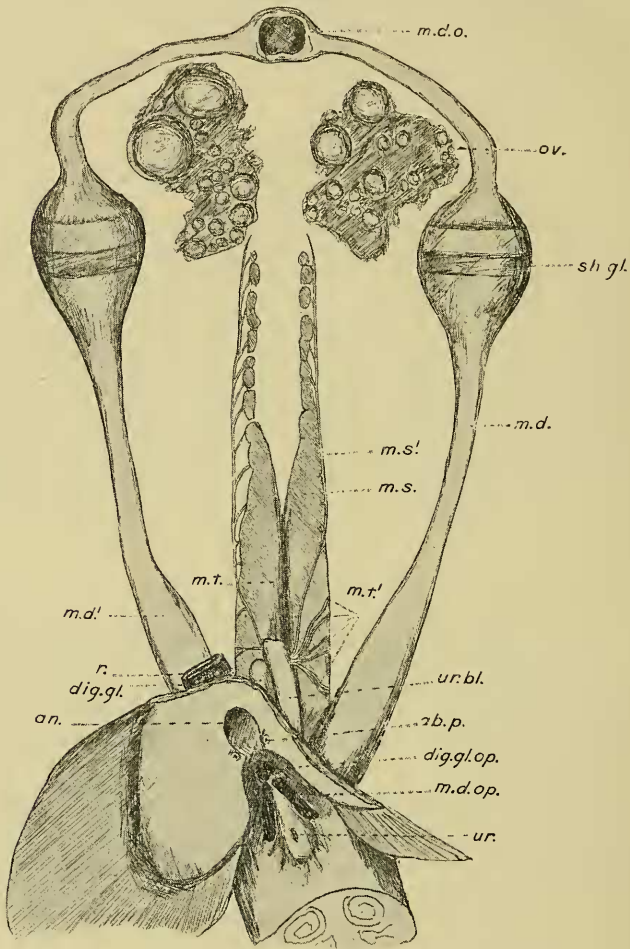
The oviducts are extremely prominent tubes differentiated into regions, opening anteriorly on the posterior aspect of the pericardial wall and in front of the liver by a single large median cœlomic opening, by which the eggs liberated from the ovaries gain access to the oviducts. For the first one-third or one quarter of their length the oviducts are of comparatively small diameter, but then rapidly increase to form the shell-glands. These almost spherical structures are external to and at the level of the ovaries, and are lined by long glandular epithelial cells which are elevated to form a circular ridge on the inner surface of the wall; this ridge in a fresh specimen appears white against the rest of the wall of the gland.

The succeeding quarter of the oviduct resembles the first quarter in diameter, after which the oviduct gradually increases in width;



this posterior uterus-like one-third opening by a wide slit-like aperture, along with that of the other side, into a depression between the pelvic fins, and not into a urogenital sinus as is the

Text-fig. 50.



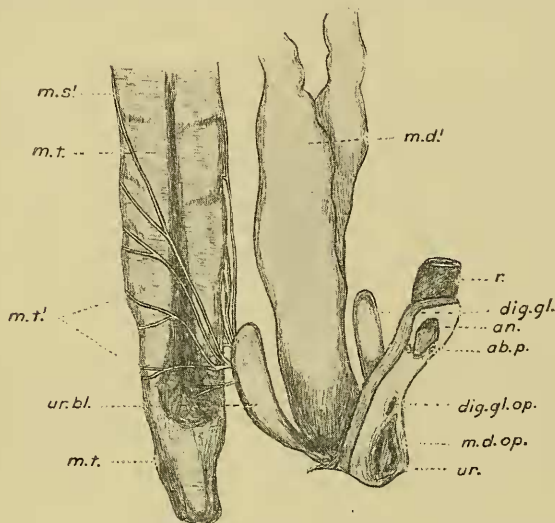
Urogenital organs of adult female *Chimæra*. Ventral view ( $\times \frac{1}{2}$ ).  
The left pelvic fin has been almost entirely cut away.

*ab.p.*, left abdominal pore; *an.*, anus; *dig.gl.*, digitiform gland; *dig.gl.op.*, its opening; *m.d.*, left oviduct; *md.op.*, left oviduct opening; *m.d.o.*, celomic opening of oviducts; *m.s.*, paired portion of kidney; *m.s'*, longitudinal duct receiving collecting ducts from *m.s.*; *m.t.*, unpaired portion of kidney; *m.t'*, special ureters from *m.t.*; *ov.*, left ovary; *r.*, cut rectum; *sh.gl.*, shell-gland of left ovary; *ur.*, opening of urinary bladder; *ur.bl.*, urinary bladder.

case in the immature female. Frequently the uterine portion of one or other or both of the oviducts is found everted from the genital opening.

The above oviducal slit-like openings are almost antero-posterior in position, and between them a rather wide ridge-like elevation is present with a single median urinary aperture near the posterior end of the ridge.

Text-fig. 51.



Dissection from right side of the posterior region of the urogenital organs of a female adult *Chimæra*.

*ab.p.*, left abdominal pore; *an.*, anus; *dig.gl.*, digitiform gland; *dig.gl.op.*, its opening; *m.d.op.*, opening of left oviduct; *m.d.*, uterine portion of right oviduct; *m.s.*, longitudinal duct receiving collecting ducts from the paired portion of the kidney; *m.t.*, unpaired portion of kidney; *m.t.*, special ureters from *m.t.*; *r.*, cut rectum; *ur.*, opening of urinary bladder; *ur.bl.*, urinary bladder.

### Urinary Organs.

These consist—as in the young male and female—of posterior unpaired and anterior paired portions. The latter are strap-shaped structures with indications of segmentation, especially anteriorly, where they diminish in size, the front end being situated about the level of the shell-glands and the posterior margin of the ovaries. By careful dissection the peritoneum covering the most anterior isolated segments may be removed, and they are then seen to lie on each side of the dorsal aorta. The paired portions of the urinary organ pass into a single median unpaired part behind, which is wide, deep, and triangular

in section, with but little signs of segmentation, and terminated posteriorly by a conical portion, which projects caudalwards some distance behind the abdominal cavity. The paired and unpaired regions are of a uniform reddish-brown colour, and have glomeruli present throughout.

Short collecting ducts pass from the lower outer borders of the segments in front, and, at intervals, from the less segmented parts of the urinary organ behind, into a longitudinal duct running along the outer margin of the paired portions, this duct extending in the peritoneum anteriorly beyond the level of the kidney, and apparently becoming attenuated and ending blindly.

The longitudinal duct of each side passes, along with six ureters from each side of the unpaired urinary organ, to open dorsally by a right and a left opening into a median large urinary bladder. The region where these ducts open is about one-third of an inch from the front blind end of the bladder; the latter becomes somewhat narrower and opens behind the oviducal openings by a median aperture at the caudal end of the ridge-like elevation described above. Hence there is no cloaca, the only indication of such being the depression between the bases of the pelvic fins, where genital and urinary organs and intestine open.

It seems probable, having regard to the rudimentary nature of the front end of the urinary organ in the adult female, and the forward prolongation of the longitudinal collecting duct beyond it, and further, the fact that the kidney extends beyond the ovaries anteriorly in the immature female, that the front end of the adult female kidney has undergone degeneration.

The rectum opens separately and about an inch in front of the oviducal apertures; the anus has on its postero-lateral margins the abdominal pore openings, which have the same relations as in the male.

#### *“Receptaculum Seminis.”*

In the ventral middle line and almost mid-way between the anus and the urinary aperture is an opening, quite prominent and just in front of the oviducal openings, which leads into a digitiform, thick muscular-walled sac, about an inch in length and called by writers from the time of Hyrtl “receptaculum seminis.” A further study of this structure shows that the above name is misleading, and that a better term would be “digitiform gland.” On examination no spermatozoa were found among its contents, but a fluid containing only globules and a large brown chitinous rod occupied the greater portion of its lumen. In all the adult females examined this rod was present, but no spermatozoa. The lining of this sac consists of long epithelial glandular cells.

## YOUNG FEMALE CHIMERA.

The urogenital organs described below were taken from an animal measuring:—

From snout to tip of whip-like tail .....	27 inches.
From snout to anus .....	9 „

There are no external sexual characters beyond the presence of the ventral median groove behind the urinary opening, which in this immature animal is about two inches long.

*Genital Organs.*

The ovaries are slightly biconvex oval structures similar in size and position to the spermaries of the immature male, but having an uneven surface already, due to the presence of ova of varying size. They are intimately associated, by means of the covering peritoneum, with the oviducts in the region of the future shell-glands, but are on the outer sides of the oviducts, and not median to them as is the case in the adult.

The oviducts closely resemble the Müllerian ducts in the immature male, being almost uniform in diameter, and having a common median coelomic opening in front, below the œsophagus. There is but a slight swelling in the shell-gland region, but further back the uterine swollen portion is already evident; the enlarged lower ends of the oviducts open separately into a median common urogenital sinus. Anteriorly the lining of the tubular oviducts is glandular and raised into longitudinal folds.

*Urinary Organs.*

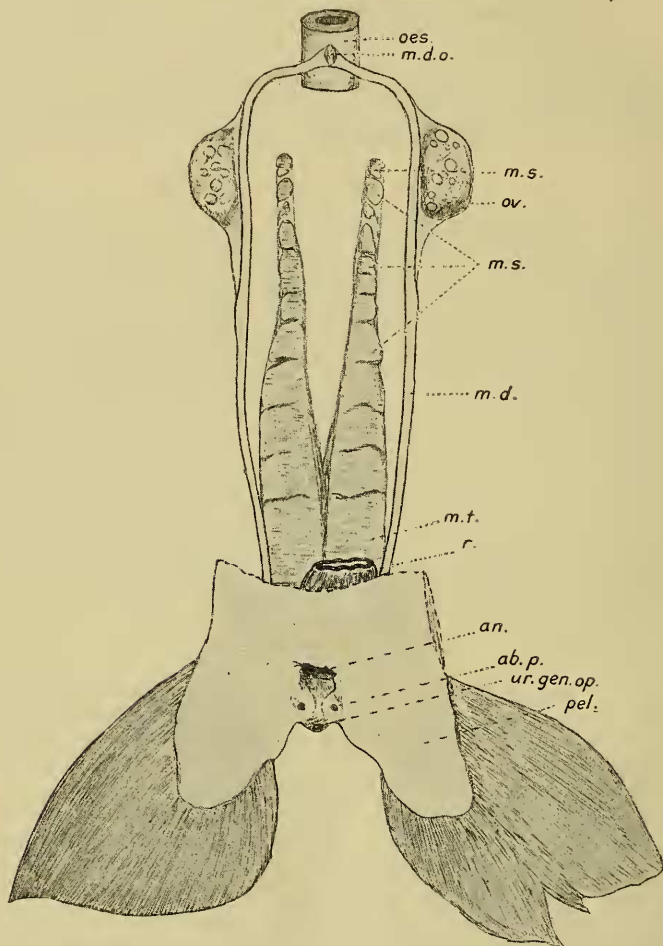
The kidney is of a uniform brown colour, segmented in front, but less markedly so behind: it consists of right and left halves which are fused together for a short distance posteriorly, in which region the organ is triangular in cross section, whereas further forward each half is strap-shaped. Glomeruli are present in twos and threes or even more in each segment.

From the posterior outer border of each segment there passes off a short duct which joins a longitudinal collecting duct, which in turn arises at the front end of each half; these ducts open close together into a median urinary bladder as in the adult. Moreover, some five or six of these ducts, on each side of the posterior region of the kidney, delay their point of opening into the main longitudinal ducts and only pass in just before the latter reach the bladder: these become the special ureters in the mature animal.

In the female the attenuation of the kidney anteriorly is not so noticeable as in the young male, although sections show that the extreme front of the immature female kidney has lost its glomeruli and that its tubules are degenerating; and thus we find

the kidney in the adult female not extending relatively so far forward in the abdominal cavity as it does in the young animal.

Text-fig. 52.

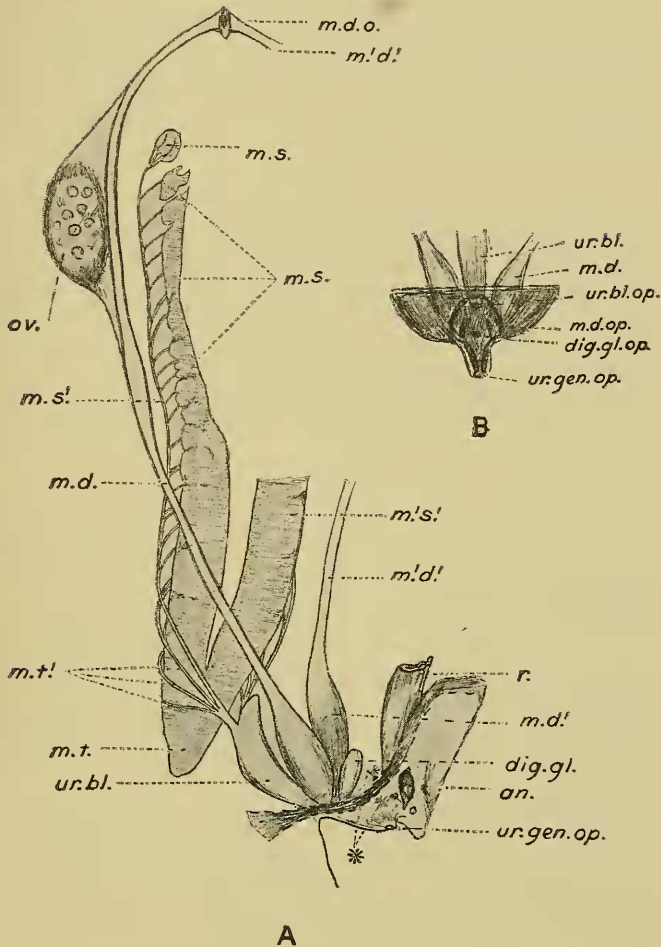


Urogenital organs of young female *Chimera*. Ventral view ( $\times 1$ ).

*ab.p.*, left abdominal pore; *an.*, anus; *m.d.*, left oviduct; *m.d.o.*, common caelomic opening of oviducts; *m.s.*, paired portion of kidney; *m.t.*, unpaired portion of kidney; *oes.*, gullet; *ov.*, left ovary; *pel.*, left pelvic fin; *ur.gen.op.*, opening of urogenital sinus.

As in the young male and the adult female the entire kidney of the young female (except perhaps the extreme front end) is excretory.

Text-fig. 53.



A. Urogenital organs of young female *Chimera* dissected from right side. Some parts of the left side have been removed.

B. Dissection of urogenital sinus of the above. The sinus has been opened, to show the apertures in its wall, by a dorsal posterior median incision.

\*, bristle passed through right abdominal pore; *an.*, anus; *dig.gl.*, digitiform gland; *dig.gl.op.*, opening of *dig.gl.* into urogenital sinus; *m.d.*, right oviduct; *m.d'*, uterine portion of left oviduct; *m'd'*, left oviduct; *m.d.op.*, opening of right oviduct into urogenital sinus; *m.d.o.*, coelomic opening of oviducts; *m.s.*, paired portion of kidney on right side; *m.s'*, longitudinal duct receiving collecting ducts from *m.s.*; *m's'*, paired portion of kidney on left side partly removed; *m.t.*, unpaired portion of kidney; *m.t'*, special ureters from *m.t.*; *ov.*, right ovary; *r.*, cut rectum; *ur.bl.*, urinary bladder; *ur.bl.op.*, its opening into urogenital sinus; *ur.gen.op.*, opening of urogenital sinus.

*Receptaculum Seminis.*

This is a diverticulum situated ventral to the oviducts and between them and the rectum. Its lining is glandular and it opens into the urogenital sinus by a median opening in front of the oviducal openings. The rod-like chitinous structure present in all adult females is absent, and so has not yet been secreted by its lining.

*Urogenital Sinus.*

This structure is well-marked in the young female: it receives in front the opening of the "receptaculum seminis," then the two oviducts open laterally further back, but a little in front of the median smaller aperture of the urinary bladder. The sinus opens on a median papilla situated a short distance behind the anus, and reminds one of the urogenital aperture of the male in appearance and position.

In the further development of the female the urogenital sinus opening gets larger and larger until the sinus is represented in the adult merely by a depression with two deep pouches bordering the oviducal openings anteriorly.

The anus and abdominal pores do not differ from the condition found in the adult.

A young female *Callorhynchus* I examined by means of sections (kidney lent to me by Prof. W. N. Parker) showed the same general arrangement of the urogenital organs.

The ovaries are comparatively short and the kidney extends further forwards. The oviducts have a single median opening into the coelom, a uniform diameter throughout, with no swollen uterine portion at this stage, and open separately immediately dorsal to the anus into a distinct cloaca. There is no sign of a "receptaculum seminis" or urogenital sinus. The abdominal pores are imperforate as yet.

The kidney possesses glomeruli throughout: it is at this stage of uniform section, and the main ureter on each side receives about four small ducts from each half of the kidney in front; the remaining five to seven small ducts from each side are posterior and enter the bladder along with the main ureter.

## SUMMARY AND CONCLUSIONS.

The following points relating to the above description deserve special notice:—

(1) The urinary organ of the young male differentiates in the adult into anterior paired Leydig's glands and posterior unpaired kidney.

(2) The glands of Leydig do not function as a renal organ as is shown by their histology and the contents of their ducts; further, the condition of the spermatozoa at intervals in the long coiled sperm-ducts (Leydig's ducts) renders it probable that the

function of the glands of Leydig is the secreting of a fluid for giving nutrition to the spermatozoa.

(3) The sexual kidney or "Geschlechtsniere" is represented in the adult male only by the rete testes, efferent ducts, and longitudinal collecting duct. Moreover, an epididymis, as usually defined, is absent.

(4) The development of the glands of Leydig is accompanied by changes in the sperm-ducts, and the formation of highly complex sperm-vesicles.

(5) The anterior region of the urinary organ undergoes a retrograde development, as is shown by a comparison of this structure in the immature and adult females.

(6) There is a distinct urogenital sinus in the young female, which does not persist in the adult.

(7) The application of the term "receptaculum seminis" to the digitiform gland found ventral to the urinary bladder is erroneous, and this structure must for the present be regarded as a female accessory genital gland of obscure function.

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March 15, 1910.

E. T. NEWTON, Esq., F.R.S., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of February 1910 :—

The number of registered additions to the Society's Menagerie during the month of February last was 80. Of these 28 were acquired by presentation, 16 by purchase, 7 were received on deposit, 17 in exchange, and 12 were born in the Gardens.

The number of departures during the same period, by deaths and removals, was 165.

Amongst the additions special attention may be directed to :—

One Mandrill (*Papio maimon*), from West Africa, presented by Dr. A. S. Griffith on Feb. 24th.

Two Bennett's Gazelles (*Gazella bennetti*), from the Isle of Hormuz, Persian Gulf, and one Punjaub Wild Sheep (*Ovis vignei*), from Banda Abbas, Persia, presented by B. T. Finch, Esq., F.Z.S., and F. W. Townsend, Esq., on Feb. 22nd.

Two Painted Finches (*Emblema picta*), from N.W. Australia, new to the Collection, received in exchange on Feb. 25th.

Two Black-hooded Parrakeets (*Psephotus cucullatus*), from N.W. Australia, new to the Collection, received in exchange on Feb. 28th.

One White-quilled Rock-Dove (*Petrhassa albipennis*), from Australia, new to the Collection, deposited on Feb. 24th.

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*Post-mortem Phenomena in a Lemur.*

The Secretary read the following account, by E. W. Shann, B.Sc., of the Gatty Marine Laboratory, St. Andrews, of some post-mortem phenomena observed in a Lemur.

Early in the morning of February 23rd, 1910, a specimen of *Lemur fulvus rufifrons* was found apparently dead in its cage in the Zoological Gardens at Giza, Egypt. The specimen had been kept in the Gardens for upwards of nine years. At 9 A.M. the animal was examined by Mr. M. J. Nicoll, Assistant Director. It was lying limp on the sand, for the limbs had not stiffened. At irregular intervals the mouth opened slightly, and an almost imperceptible motion passed through the thoracic region. Mr. Nicoll says that lemurs and some monkeys not infrequently undergo a more or less protracted moribund condition before death actually occurs. This is particularly the case with old specimens, and no case is known in which the animal has recovered from this condition.

At 11 A.M. Capt. S. S. Flower, Director, gave the lemur to the present writer for the purpose of dissection. By this time there was no movement of the jaws, but the limbs were still limp. After a few minutes the gasping recommenced. This may have been due to the warmth of the hand. Dissection was postponed, and Mr. Nicoll tried the effects of artificial respiration. The gasping became more frequent, and at fairly regular intervals of 40-50 seconds. No heart action could be detected. The spasmodic movements again died away. The eyes had a glazed appearance, but as the animal had been blind for a considerable period, this was no clue to its condition.

At 2 P.M. the eyelids were found to be closed, and there was no movement of the jaws. Dissection was commenced. It was observed that the blood flowed slowly from a slit in the jugular vein; that is to say, the blood was not congealed. The limbs were still limp. On opening the costal region a muscular contraction of the heart was noticed. After touching the heart with the handle of a scalpel further contractions took place, and continued for more than a minute. At 4 P.M. this heart action was observed by Capt. Flower. The dissected lemur was then left, covered with a damp cloth, till 6.30 P.M. when it was again examined by Capt. Flower, Mr. Nicoll, and the writer. The muscular contractions of the heart were very evident, though the limbs were rigid by this time. Further observations were made at 9 P.M., 10.15 P.M., 11.15 P.M., and 1 A.M. the following day. The contractions could be easily induced, but later the response became feebler. At 8.30 A.M.—a whole day after the apparent death of the animal—a slight muscular action could still be induced in the auricles, but no longer in the ventricles. By 2 P.M. all motion had ceased. No means were at hand for testing the effect of electricity upon the organ in question.

That this is a case of reflex action seems to be the probable

conclusion ; for, at least in the later phases, the animal was dead, in the generally accepted sense of the word.

—

*A new Potto from British East Africa.\**

Mr. Oldfield Thomas, F.R.S., F.Z.S., exhibited the skin of a Potto which had been obtained in British East Africa, the first specimen from elsewhere than on the West Coast of Africa received by the National Museum.

The species was quite distinct from the western forms, and was proposed to be called—

PERODICTICUS IBEANUS THOS.†

Abstract P. Z. S. 1910, p. 17 (March 22nd).

A long-haired Potto, blackish anteriorly, grey posteriorly.

Size about as in the Gaboon *P. batesi* deWint. Fur soft and thick, the wool-hair on the back nearly 20 mm. in length, and the straight hairs 25–26 mm. General colour grizzled ashy, but the shoulders and fore-back blackish, the contrast between the two colours very marked. Head brownish clay-colour, the extreme tips of the hairs blackish ; these dark tips broadening posteriorly so as to make the nape and fore-quarters almost black, with a hidden suffusion of dark clay-colour. The long bristle hairs of the crown and nape black. Rest of the body, behind the withers, grizzled ashy, the longer hairs dark with greyish-white tips, the woolly underfur dark slaty basally, then broadly clay-coloured, and with dark tips. Under-surface greyish, not sharply defined, the hairs slaty basally, dull greyish white terminally (grey no. 8). Arms and legs grizzled ashy like the body ; hands and feet buffy brownish. Tail comparatively long, cylindrical, ashy grey.

Skull about as large as in *P. batesi*, but the teeth small as in *P. potto*. Nasals very short.

Canines rather slender. Anterior premolar long, pointed, two-thirds the height of the canine. Other cheek teeth all very small ; second molar smaller than the first. Anterior lower premolar longer than posterior.

Dimensions of the type, measured in flesh :—

Head and body 339 mm. ; tail 68 ; hind-foot 76 ; ear 25.

Skull—upper length 64 mm. ; basal length 55 ; greatest breadth 46 ; nasals 14·2 × 5·3 ; interorbital space 9·3 ; length of cheek-tooth series 16·5 ; of molars only 8·5 ; breadth of m<sup>1</sup> 3·8, of m<sup>2</sup> 3·2.

*Hab.* Kakamega Forest, near Mount Elgon, British East Africa, alt. 6000'.

\* Published by permission of the Trustees of the British Museum.

† [The complete account of the new species appears here, but the name and a preliminary diagnosis were published in the 'Abstract,' No. 81, 1910.—EDITOR.]

*Type.* Young adult male. B. M. No. 10.3.18.1. Original number 515. Killed 4th Jan., 1910. Presented by Messrs. Maturin and Brett through Mr. R. Kemp.

This fine species of Potto was no doubt that from Uganda mentioned by Sir Harry Johnston\*, and, with the exception of that mention, represented a considerable extension of the known range of *Perodicticus*, the genus having been otherwise recorded only from the West Coast.

*P. ibeanus* was at once distinguishable from all others by the hoary colour of its back, which contrasted markedly with its blackish shoulders, the difference being due to the long hairs of the former being broadly tipped with ashy, a character not found in any other Potto. Its coat also was of an unusually soft rich nature, in agreement with the considerable elevation of its habitat.

The specimen had been given by Messrs. Maturin and Brett to Mr. R. Kemp, who was collecting for the National Museum on behalf of Mr. C. D. Rudd.

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Mr. D. Seth-Smith, F.Z.S., M.B.O.U., Curator of Birds, communicated the following account of some living examples, in the Society's Gardens, of the Black-hooded Parrakeet (*Psephotus cucullatus* North):—

The Society has recently acquired by exchange a pair of Parrakeets of the genus *Psephotus*, which were originally obtained from Mr. A. E. Jamrach, who informs me that in all ten pairs arrived in Europe some few months since. These birds were at first believed to be Golden-shouldered Parrakeets (*Psephotus chrysopterygius*), and a pair was shown at a recent bird-show at the Crystal Palace under this name. In examining the pair, however, I noticed that the male bird lacked the yellow frontal band characteristic of that species, and that the black marking on the head extended to the base of the bill, over the lores and completely surrounded the eye; and moreover, the yellow patch on the wings appeared to be more extensive than in *P. chrysopterygius*. I thought at first that these birds were referable to a species described in the P. Z. S. of 1898 by Professor Collett as *Psephotus dissimilis*, but on looking up the description of these I found that the crown is chestnut according to Collett and dark brown according to Hartert†. I have since discovered a reference to this black-crowned form in the 'Victorian Naturalist' for 1909, where Mr. North publishes a note, dated Feb. 6, 1909, on these birds, probably the very lot of which the Society's pair formed part.

They were captured by Mr. Fritz Kruger in the Northern Territory of South Australia, 200 miles south-east of Port Darwin, which is the locality *P. dissimilis* is said to inhabit.

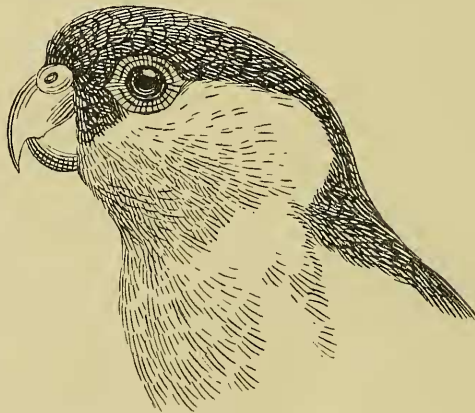
\* 'Uganda,' vol. i. p. 364, 1902.

† Nov. Zool. vol. xii. p. 214 (1905).

Mr. North examined them on their arrival in Sydney, and at first believed them to belong to that species, but subsequently noticed the characters to which I have referred. He was able to examine no less than sixteen specimens, five of which were adult males entirely lacking all trace of the brown frontal band that characterises *P. dissimilis*.

He writes, "What I regard as the chief point of difference is that not only are the lores, forehead and crown of the head of the adult male *black*, but that this colour extends down the anterior portion of the cheeks to the base of the lower mandible. Viewed in front, the bird appears to wear a black mask or cowl. Should it prove to be distinct I propose to distinguish it under the name of *Psephotus cucullatus*, and vernacularly as the Black-hooded Parrakeet."

Text-fig. 54.



Head of *Psephotus cucullatus* North.

In the Society's pair of birds the male is rather rough in plumage at present, but shows quite distinctly the characters above described, and I think there is no doubt that Mr. North is right in ascribing this to a new species.

The female of *P. cucullatus* lacks any trace of the yellowish frontal band which is present in the female of *P. chrysopterygius*; but it agrees fairly well with Professor Collett's description of *P. dissimilis*.

The recent consignment of these Parrakeets does not appear to be the first arrival of *P. cucullatus* in Europe, for Mr. Blaauw informs me that he has some specimens in his aviary at Hilversum, Holland, which he received last summer. Moreover, a pair of birds received alive by Mrs. Johnstone, of Burswood, Groombridge, so long ago as 1902 or 1903, of which the skin of

the female is in my possession, and that of the male in the possession of Mr. Fasey, of Snaresbrook, Essex, undoubtedly belong to the race recently described by Mr. North.

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The Secretary read the following letter which had been sent him by Mr. George Jennison, of the Zoological Gardens, Belle Vue, Manchester:—

“We attribute our success in breeding Pine Snakes solely to the provision of a suitable habitat.

“The adults were turned into our large snake cage in the beginning of June, and evinced such a desire to enter the conservatory, which for purposes of atmosphere forms part of the cage, that we gratified them by making a small hole through which they could pass.

“Some of the boas show a similar preference for the conservatory, but to nothing like the same extent as the Pine Snakes.

“They revelled in the rank vegetation and speedily disappeared below ground in burrows probably of their own construction. There among the soil, which has a temperature of 90° or so, they perfected their family arrangements.

“Their success came to us somewhat as a dramatic surprise.

“On October 18th, a Pine Snake 13 inches long was discovered on the floor of the greenhouse which adjoins the snake cage.

“It had passed between the slates that form the bed of the conservatory down among the heating pipes where the temperature would be 100° or more, and thence through a well-worn opening about the size of a mouse hole to the place where it was found.

“Seven or eight snakes were collected during the next few days, several being among the heating pipes. All were very lively and in excellent condition. They were similar in colour and pattern to the parents.

“Four we put in a cage apart, and the keeper Craythorne says he saw them on several occasions take worms, but they were obviously not doing as well as those left to their own resources; so we returned them to the old home where they immediately disappeared under the soil. Burrowing to such an extent, they are rarely seen, but a specimen captured in good condition on March 7th measured 16½ inches, a growth of 3½ inches in about four months.

“We have no knowledge of the number of the brood nor one may say of their distribution, as they have been found in good order in our temperate greenhouse twenty yards from their birth-place.”

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Mr. Charles Sillem exhibited some living specimens of the Crustacean *Chirocephalus diaphanus* recently caught in a flooded ditch on Eton Wick Common.

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